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LIMNOCITRUS, A NEW GENUS, ALSO NEW SPECIES OF WENZELIA, PARAMIGNYA AND ATALANTIA (RUTACEAE–AURANTIOIDEAE)

WALTER T. SWINGLE

With four plates

THE PRESENT paper adds one new genus and several new species to the Orange subfamily AURANTIOIDEAE of which I am preparing a synopsis to be published shortly. This paper supplements the one that I published in this JOURNAL last April.[1]

Some seventy-five years ago (about 1862) a curious plant was discovered by J. E. Teysmann, a well known botanical collector, growing near the seashore at Rembang on the north shore of the island of Java. In 1864 this plant was published as a new species by F. A. W. Miquel and placed doubtfully in the genus *Paramignya* (*P. ? littoralis*). The discoverers of the plant, J. E. Teysmann and S. Binnendijk, published also in 1864 additional notes based on Teysmann's observations. Herbarium specimens of the type material were sent to the National Herbarium (Rijks Herbarium) at Leiden, Holland, and to the Botanical Garden at Buitenzorg in Java. This plant then disappeared from notice for nearly half a century. In 1912 Valeton published a lithographic plate of this species based on the original type material deposited in the herbarium at Buitenzorg. The plant was rediscovered at about this time in Annam, French Indo-China, at Nha-trang and a few years later to the north at Tourane near the seashore.

Thanks to the loan of Miquel's type specimen from the Rijks Herbarium at Leiden and excellent material from Indo-China found in several

[1]Swingle, Walter T., *Clymenia* and *Burkillanthus*, new genera also three new species of *Pleiospermium* (in Jour. Arnold Arboretum **20:** 250–263, pls. 1–3. 1939).

American herbaria, I have been able to work out the morphology of the flowers and fruits by using the modified Juel technique.[1]

As a result of these studies, I find that this little known plant, variously classed in the genera *Paramigyna*, *Limonia*, *Atalantia* and *Pleiospermium* by leading taxonomic botanists familiar with the genera of *Rutaceae*, cannot be placed in any of these genera, but is the type of a new genus for which I propose the name *Limnocitrus*.[2]

Limnocitrus, gen. nov.

Pleiospermio affine sed differt (1) foliis simplicibus, (2) petiolis apteris, brevissimis, pulvinoideis, (3) disco cupulato, (4) ovario longitudinaliter multisulcato, costis minutissime inter sulcos hirsutis, (5) vesiculis pulpiferis gracilibus, elongatis subfusiformibus, ad basim plus minusve contractis.

Frutex vel arbuscula, 2–3 m. alta, ramulis glabris, spinis singulis axillaribus; foliis simplicibus, coriaceis, late ellipticis vel obovatis, apice obtuse vel truncate acuminato, ad basim cuneatis; petiolis brevissimis (quam lamina decemplo vel plus brevioribus), pulvinoideis, non-articulatis; floribus 4- vel 5-meris; pedicellis brevibus, glabris; alabastris magnis, oblongis, viridibus; calycibus latis, 4–5-lobatis, lobis triangularibus, obtusis; petalis crassis, lineari-lanceolatis, viridi-albis; staminibus 10, filamentis liberis, glabris, antheris linearibus; disco cupulato; ovario oblongo-ovoideo, 12–20-sulcato, hirsuto, loculis 4 vel 5, ovulis 2 in quoque loculo; stylo gracili, paulo pubescente, stigmate paulo capitato; fructu globoso vel subgloboso, magno, pericarpio glanduloso-punctato, aureo-flavo, maturitate vesiculis pulpiferis numerosissimis gracilibus acutis ad basim contractis instructo; seminibus magnis, ovoideis, plus minusve applanatis, mono-embryonatis.

TYPE SPECIES: *Paramignya ? littoralis* Miquel in Ann. Mus. Bot. Lugd.-Bat. **1**: 211 (1864).

DISTRIBUTION: East India, Rembang, Java (type locality), Bali; French Indo-China (Annam and Cochin China).

This genus somewhat resembles *Pleiospermium* but differs from it in many important characters that are not shown by any of the five known species of that genus. *Limnocitrus* has thick, coriaceous, veiny, simple

[1]Swingle, Walter T., Clymenia, etc., l.c. 251, also Tillson, Albert H. & Bamford, Ronald, The floral anatomy of the AURANTIOIDEAE (in Amer. Jour. Bot. **25**: 780–793. 1938). Dr. Tillson again gave me his skilled assistance in preparing serial microtome sections of the plants discussed in this paper.

[2]From the Greek λίμνη, swamp or salt marsh, and *Citrus*, in allusion to its frequent occurrence in tidal marshes which are subject to occasional overflow of brackish water.

leaves borne on very short (about 1/10 as long as the leaf-blade), wingless petioles which are pulvinoid for their entire length and not articulated with the leaf-blade (Plate 1, figure 1), while the leaves of *Pleiospermium* are thinner, less veiny, and have long, well-developed petioles often winged and always articulated with the leaf-blade. *Limnocitrus* has a cup-shaped disk, and a relatively very large calyx expanded by the petals which are thickened toward the base and reflexed at the tips in anthesis. The ovary is most unusual in having numerous (12–20) longitudinal furrows with narrow ridges between, bearing numerous long, white bristles (Plate 1, figures 2, 6).

The fruits, which resemble small oranges, have the locules filled with long slender pulp-vesicles that taper to an acute apex and are more or less bluntly contracted where they are attached to the dorsal walls of the locules (Plate 1, figures 4, 5). The characters shown by these pulp-vesicles clearly distinguish *Limnocitrus* from the other related genera which I place in the subtribe *Citrinae* of the tribe *Citreae*. *Limnocitrus* and the genera most clearly related to it, *Severinia*, *Pleiospermium*, *Burkillanthus* and *Hesperethusa*, constitute a group which I have called Primitive Citrus Fruit Trees.[1]

The pulp-vesicles of *Limnocitrus* are somewhat intermediate in character between those of *Pleiospermium* and those of the True Citrus Fruit Trees such as *Citrus* and closely related genera. The fruits of *Limnocitrus* were described by A. Guillaumin (in Bull. Soc. Bot. France, **60**: 442. 1913), in translation as follows: "The fruits, as a matter of fact, resemble small oranges about 4 cm. in diameter, with 5 locules almost completely occupied by the 2 very large seeds surrounded by succulent hairs as in the genus *Citrus* and in *Atalantia citroides*."

Although *Limnocitrus* is apparently a connecting link between The Primitive Citrus Fruit Trees, such as *Pleiospermium*, and the True Citrus Fruit Trees such as *Microcitrus*, it must be kept in mind that *Limnocitrus* shows striking characters in the ovary with its numerous longitudinal furrows separating low ridges which carry lines of long, white bristly hairs — characters not found in any other genus of the tribe *Citreae* or even in any of the whole subfamily AURANTIOIDEAE.

Limnocitrus littoralis (Miquel) Swingle, comb. nov. PLATE 1

Paramignya ? littoralis Miquel in Ann. Mus. Bot. Lugd.-Bat. **1**: 211. 1864; Teysmann and Binnendijk in Natuur. Tijdschr. Nederl.-Indië **27**: 41. 1864.

Limonia littoralis (Miq.) Backer, Schoolflora voor Java, 185. 1911.

[1]Swingle, Walter T., A new taxonomic arrangement of the Orange subfamily, *Aurantioideae* (in Jour. Wash. Acad. Sci. **28**: 530–533. 1938).

Atalantia littoralis (Miq.) Guillaumin in Bull. Soc. Bot. France. **60**: 442. 1913.

Pleiospermium littorale (Miq.) Tanaka in Bull. Mus. Hist. Nat. Paris 2. sér. **2**: 52. 1930.

ILLUSTRATIONS: Th. Valeton in Icones Bogorienses. **4**: 163, 164, pl. 349. 1912.

Species unica.

It is now possible, thanks to excellent material of this species at my disposal, to give a fairly complete description of this plant.

A shrub or small tree, 2 meters high, with stout, straight, single spines; leaves simple, glabrous, thick, coriaceous, broadly oval, bluntly pointed at both ends, margins entire or faintly crenulate; leaf-blades 5–7.5 × 3–4 cm.; with 8–11 pairs of lateral veins, arising at an angle of 40° to 60° with the midrib, usually straight but sometimes bending to the right or left to unite with the neighboring lateral vein, tertiary or quaternary veinlets forming coarse, irregular, inconspicuous reticulations; oil glands small, very numerous; petioles cylindrical 3.5–7 × 1–1.5 mm., pulvinoid, minutely puberulous on the upper side inside the shallow channel bounded by the decurrent leaf-margins; inflorescences terminal (sometimes arising on modified spines!), compact, corymbose, with widely divergent, short, stout branches; calyx glabrous within, finely pubescent without, 4–5-lobed, lobes very broad, bluntly pointed, with short-ciliate margins; petals thick, white within, green without in the bud and greenish white when expanded, linear-oblong, blunt-tipped, 10–11 × 3 mm., glabrous except for scattered puberulence near the tip; stamens with glabrous filaments, anthers long and slender with a large dorsal oil-gland; disk cup-shaped 0.5–0.6 mm. high, inclosing loosely the base of the ovary (Plate 1, figure 2); pistil 10–11 mm. long; ovary obovoid, 4.5–5 mm. high, 1.7–2 mm. wide, flattened at top, obscurely furrowed in the middle portion with from 12–20 slight narrow ridges from which arise scattered long hairs in a nearly vertical line, tetragonal or pentagonal at the top because of 4 or 5 large sunken oil-glands (one over each locule); locules 4–5, each with 2 pendant collateral ovules; style about 6 mm. long, 1.8–2 mm. thick, terete, sparingly pilose above, increasingly so toward the base, stigma depressed-capitate, 1.8–2 mm. wide, 0.7–0.8 mm. high, with 4–5 radially arranged linear stylar canals, with 2 (rarely 1) large oil glands between each adjoining pair of stylar canals; fruits subglobose, 37–40 mm. in diam., pericarp thin, dotted with oil-glands, containing very numerous, very slender, fusiform pulp-vesicles 9–11 mm. long, abruptly truncate and 0.5–0.8 mm. in diam. at the base where attached to the dorsal wall of the locule; the broadest portion (1.6–1.8 mm. wide) of the pulp-vesicle is located about 1/10–

1/6 of the distance from the base to the slender apical portion, often matted and tangled in dried specimens; seeds large, long-obovate, 17–18 × 9–11 × 3.5 mm., with a smooth, firm, yellowish gray testa, mono-embryonic; cotyledons green, gland-dotted.

TYPE: East Indies, Java, on strand near Rembang, *J. E. Teysmann, no number* (Rijks Herbarium, Leiden, sheet no. 925,250–602, flowers lacking, 1 fruit seen and studied; photostat of entire sheet and photographs of fruit and foliage also 15 serial microtome sections of fruit [S. and T. no. 547 A, slides 1, 2, 3] filed in Herb. National Arboretum, Washington).

COTYPE: Java, Rembang, *J. E. Teysmann* (Rijks Herbarium, Leiden, sheet with Tanaka's identification label "R.841"; not seen, photograph of part of this sheet by T. Tanaka [no. 3813] in Herb. National Arboretum).

OTHER MATERIAL: Buitenzorg, Java, Collector ? *"ex herb. hort. bot. bog. III. G. 3. 1903."* (Herb. Bur. Sci. Manila, fruiting branch; photostat of sheet and photographs of details in Herb. National Arboretum). Bali, *collector ?* (Rijks Herbarium, sheet no. 908,203–1384, examined at Leiden; photograph from Rijks Herbarium no. "2.85 — 1912"; in Herb. National Arboretum). French Indo-China, Annam, Nha-trang, *C. B. Robinson no. 1504*, March 11–26, 1911 (Herb. Bureau Science, Manila; photostat and photographs in Herb. National Arboretum). Annam, Nha-trang, *Aug. Chevalier no. 30526*, 6/2/1916, fruiting branch (Herb. National Arboretum). Annam, Tourane, *J. and M. S. Clemens nos. 3263 and 3823* (Herb. Arnold Arboretum and National Herbarium, also same numbers in Herb. Bot. Museum, Berlin-Dahlem; all seen and studied, photostats of sheets and detail photographs of leaves, flowers and fruits filed in Herb. National Arboretum).

Limnocitrus littoralis is a striking plant because of its thick, veiny leaves, rigid, straight thorns, abundant clusters of greenish white flowers and fruits that look like small oranges. It is called *kim do um* by the natives at Nha-trang, Annam, and doubtless because of this is not difficult to find in this locality.

Because of its habitat, in tidal marshes subject to recurrent inundations at spring tides, this plant is almost certain to possess a rather high tolerance to salinity in the soil moisture. *Citrus* can be grafted on *Merope angulata*,[1] another salt-tolerant Citrus relative, but so far has made only unsatisfactory growth on this stock. However, *Limnocitrus littoralis* is undoubtedly much more closely related to *Citrus* than is

[1]Swingle, Walter T., Merope angulata, a salt-tolerant plant related to Citrus, from the Malay Archipelago (in Jour. Wash. Acad. Sci. **5**: 421–425, 2 figs. 1915).

Merope angulata which is a member of another subtribe, *Triphasiinae*. Another Citrus relative *Eremocitrus glauca*[1] (more closely related to *Citrus* than is *Limnocitrus*) native to more or less saline flats in dry regions of N. E. Australia is salt- and boron-tolerant and supports *Citrus* well when used as a rootstock.

As *Limnocitrus* is easily obtainable, it should be introduced into culture and tested as a root stock for *Citrus*.

THE GENUS WENZELIA

Some 25 years ago Dr. E. D. Merrill founded a new genus, *Wenzelia*, on a single new species, *W. brevipes*, discovered in Leyte, one of the southern islands of the Philippines. In 1928 Tyôzaburô Tanaka transferred *Citrus paludosa* Lauterbach and *C. dolichophylla* Lauterbach & K. Schumann, to the genus *Wenzelia*. In 1938 I also transferred *Citrus grandiflora* Lauterbach to *Wenzelia*. Unfortunately these three species, all native to New Guinea, were, and still are, only imperfectly known and it may prove difficult to secure additional and better material of them from this vast and still only very inadequately explored island.

It is a great pleasure to be able to add to this genus no fewer than five new species, all of them better known than any of the old species except Merrill's type species, *Wenzelia brevipes*. I discovered three of the five new species in herbarium specimens sent to me for study by Dr. Merrill from the rapidly growing collections of the Arnold Arboretum. Dr. Merrill also called to my attention the curious tree discovered by Dr. A. C. Smith in the Fiji Archipelago that proved to be another new species of *Wenzelia*. The type specimen has been lent to me by the New York Botanical Garden.

Finally I am naming, with some hesitation, a new variety of *Wenzelia brevipes*, found on Alabat Island in the Philippines. Thanks to these new discoveries *Wenzelia* is now the largest genus in the southeastern part of the range of the Orange subfamily, from the southern islands of the Philippines to New Guinea, the Solomons and Fiji Archipelago.

It also appears that among the six well-known species of *Wenzelia* there are two well-marked groups of species characterized by two very different types of seeds. One group, typified by the type species of the genus, *Wenzelia brevipes*, has only a few large thick seeds; the other group, not known until I discovered two new species from New Guinea and one from the Solomons, has many seeds (sometimes as many as 30 in a single fruit) which are flattened and often more or less curved or

[1] Swingle, Walter T., Eremocitrus, a new genus of hardy drouth-resistant Citrus fruits from Australia (in Jour. Agr. Res. **2**: 85–100, 7 figs. pl. 8. 1914).

bent by mutual pressure. These flat-seeded species of *Wenzelia* are obviously related to the curious *Monanthocitrus cornuta*, native to southwestern New Guinea. This latter plant belongs to a monotypic genus; it has leaves much like those of *Wenzelia*, but much smaller flowers, and very thin, saucer-shaped seeds covered with small red-brown spots and having thin fimbriate margins. Until the thin-seeded species of *Wenzelia* were discovered, *Monanthocitrus* was one of the most isolated genera of the whole tribe *Citreae*.

The six genera of the Orange subfamily, restricted to the southeastern or Monsoon area are *Clymenia* (Bismarck Archipelago), *Monanthocitrus* (New Guinea), and *Eremocitrus* (N. E. Australia), all three monotypic genera, *Oxanthera* with four species (New Caledonia), *Microcitrus* with six species (N. E. Australia and New Guinea) and *Wenzelia* with nine species (S. Philippines to New Guinea, Solomons and Fiji Archipelago). *Wenzelia* is not only the largest of these six genera, but also the most widely distributed. All of these genera of exclusively southeastern distribution, belong to the tribe *Citreae* which contains 28 genera of which only five genera, *Luvunga* (12 sp.), *Paramignya* (15 sp.), *Citropsis* (11 sp.), *Atalantia* (10 sp.) and *Citrus* (16 sp.) are larger than *Wenzelia*.

A striking proof of the rapid advance of our knowledge of the *Citrus* relatives is furnished by the fact that not a single one of the nine species that now constitute the genus *Wenzelia* had been described up to 1901! The second species was published in 1910, the third in 1915 (when the genus *Wenzelia* was established), a fourth in 1918 and the other five are only now described in this paper.

It is very probable that still more species of *Wenzelia* will be found as New Guinea, Celebes, the Moluccas and the Bismarck Archipelago are more thoroughly explored.

I give without further delay descriptions of the five new species and one new variety of *Wenzelia*.

Wenzelia Archboldiana, sp. nov. PLATE 2, FIGURES 1–5.

Wenzeliae brevipedi affinis sed differt (1) seminibus planis, plus minusve curvatis, in loculis dense confertis et plus minusve deformatis, (2) loculis ovarii ovula 6(–8) gerentibus, (3) fructu oblato-sphaeroideo apice basique depresso, loculis 5 inflatis.

Arbor inermis, 3–5 m. alta; foliis ovato-lanceolatis vel lanceolatis, 16–22 × 7–9 cm., apice plus minusve acutis, basi cuneatis, marginibus integerrimis vel leviter crenulatis, nervis lateralibus utrinque 10–14, sub angulo 60–70° divergentibus; petiolis brevissimis, 4–8 × 1.5–2 mm.;

floribus plerumque 2 in axillis foliorum terminalium; alabastris ante anthesin 23 × 4 mm. (Plate 2, figure 4); pedicellis 4–5 × 0.8 — 1 mm.; calycibus 4–5 mm. longis, apice 3–4 mm. latis, lobis calycis brevibus, 1 × 3 mm., rotundatis, extus et in margine minute pubescentibus; petalis 5 (vel 4), albis, 15 × 4.5 mm. (in alabastro), glandulis oleiferis instructis, glabris, marginibus tenuibus scariosisque; disco brevi cylindrico; basi ovarii isodiametrali, 0.9 mm. alto, 1.7 mm. lato, in stylum subito constricto; loculis ovarii 6- vel 8-ovulatis; stylis cylindricis 4.5 × 0.5–0.6 mm., stigmatibus globoso-depressis, 1 mm. altis, 2 mm. latis; fructibus saepe duobus in axillis foliorum ultimorum, oblato-sphaericis, 2.5–3 × 3–3.5 cm., 5-locularibus, loculis intumescentibus sectionem transversalem stelliformem lobis 5 obtusis formantibus, (Plate 2, figures 1, 2); seminibus pluribus, ad 6 vel 8 (!) in quoque loculo, planis plus minusve curvatis, 15–17 × 10–11 × 1.5–3.5 mm., brunneo-fuscis; embryone unico.

A thornless shrub or small tree, 3–5 m. high; leaves ovate-lanceolate or lanceolate, 16–22 × 7–9 cm., more or less abruptly acuminate at apex, cuneate at base, margins entire or slightly crenulate, lateral veins 10–14 on each side, arising at an angle of 60°–70° with the midrib, petioles very short, 4–8 × 1.5–2 mm. (1/25 to 1/40 of the length of the leaf-blade), flowers usually arising in pairs in the axil of the terminal leaf, flower-buds ready to open 2.3 × 4 mm.; pedicel 4–5 × 0.8–1 mm., calyx 4–5 mm. long and 3–4 mm. wide at the top, calyx-lobes short (1 mm. long, 3 mm. wide), broadly rounded, minutely pubescent on the back and margin; corolla white, petals 5 (or 4), 15 × 4.5 mm. (in the bud), dotted with oil-glands, glabrous, margins thin and slightly scarious; pistil 12–12.5 mm. long (immediately after the petals fall); disk short, cylindrical, 0.9 mm. high, 1.7 mm. wide, narrowed to 1 mm. at the suddenly constricted junction with the ovary (Plate 2, figure 5); ovary with stalk 6–7 × 3 mm., 5-locular, each locule with 6 (or 8!) collateral ovules, style cylindrical, 4.5–5 × 0.5–0.6 mm., stigma cushion-shaped, 1 mm. high, 2 mm. wide; fruits often paired in the axil of the uppermost leaf of fruiting twig, depressed globose, 2.5–3 cm. high, 3–3.5 cm. wide, 5-locular, locules bulged, making fruit star-shaped in cross section with very blunt, rounded rays (Plate 2, figures 1, 2); seeds several (up to 6 or 8!) crowded into each locule, flat and more or less curved or bent, 15–17 × 10–11 × 1.5–3.5 mm., brownish-gray (after soaking in formaldehyde), mono-embryonic.

TYPE: New Guinea, Papua, Lower Fly River in rain forest, opposite Sturt Island, *L. J. Brass no. 8038*, October 1936, fruiting branch (Herb. Arnold Arboretum, photographs and seeds in Herb. National Arboretum).

OTHER MATERIAL: New Guinea, Morobe District, Ulap, hill forest, alt. 650 meters, *M. S. Clemens no. 6673*, Aug. 3, 1937, flowering twig (Herb. National Arboretum). New Guinea, Morobe District, Sattelberg, hill forest, alt., 1000–1200 meters, *J. and M. S. Clemens no. 1057*, Dec. 3, 1935, branch with very young fruit (Herb. Berlin-Dahlem; photograph in Herb. National Arboretum).

Wenzelia Archboldiana has leaves and flowers much like *W. melanesica* from the Solomon Islands some 2000 kilometers to the east, but has very different oblate-spheroid fruits while those of *W. melanesica* are slender and taper to a sharp apex. On the contrary, *W. Archboldiana* is decidedly different in all its characters of leaf, flowers and fruits from *W. platysperma* which is native to the same part of New Guinea. All three species just named are alike in having flattened, thin-margined seeds.

The two fruits of the type specimen of *Wenzelia Archboldiana* show several, often 5–8, fusiform cracks, 8–12 mm. long and 3–5 mm. wide at their broadest, in the outer pericarp, radiating from the axis at the base and at the tip of the fruit (Plate 2, figure 1). Most of these cracks run along the center of the locule wall but some cracks, usually smaller, radiate along the boundary of two adjacent carpels.

This striking new species has been named in honor of Mr. Richard Archbold who has organized and led three great collecting and exploring expeditions to New Guinea and, by employing expert collectors like L. J. Brass, has brought back many thousands of herbarium specimens representing the remarkably interesting plants of New Guinea.

Wenzelia melanesica, sp. nov. PLATES 2, FIGS. 6–8; 3, FIGS. 1–3.

Wenzeliae Archboldianae proxime affinis, sed differt (1) fructu irregulariter cylindrico, angulis 4–5 instructo, ad apicem elongato-apiculato, (2) seminibus tenuioribus, non deformatis.

Arbor inermis, 7 m. alta; foliis glabris, ellipticis, apice acuminatis, basi rotundatis, margine integerrimis vel paulo crenatis, nervis lateralibus utrinque 12–18, subtus conspicuis, sub angulo lato (70°–80°) divergentibus; petiolis brevissimis, 4–5 mm. longis, 1–1.3 mm. latis, glabris, non articulatis; floribus singulis vel 2–3 in axillis foliorum; pedicellis brevibus (4–6 mm.), bracteis minutis margine ciliatis suffultis; calycibus 4–5-lobatis, lobis rotundatis 1.3–2 × 1.5–2 mm., marginem versus accrescenter pubescentibus, copiose ciliatis; corolla 4–5-mera, petalis albis, staminibus 8–10, ovario 4–5-mero, loculis 6-ovulatis; fructu irregulariter 4–5-angulato, in apicem acutum attenuato (Plate 2, figures 6, 7), 4.5 × 2.3 cm.; pericarpio glandulis oleiferis numerosis minutis (0.1–0.2 mm.), leviter impressis instructo; seminibus tenuibus, planis,

ovatis, 9–13 × 6.5–9 × 1.5–2 mm. (Plate 2, figure 8), fusco-canis, marginibus tenuissimis subintegris, pallidioribus quam seminibus, embryone unico.

A thornless small tree up to 7 m.; leaves glabrous, elliptical, acuminate at the apex, broadly rounded at the base, margins entire or slightly crenulate; lateral veins 12–15 pairs clearly marked below, arising at a large angle (70°–80°) with the midrib; petioles very short, 4–5 × 1–1.3 mm., glabrous, not articulated with the blade; flowers solitary or in small groups (2–3) in the axils of the leaves (Plate 3, figure 3); pedicels short (4–6 mm.), with very small ciliate bracts at the base, expanding gradually into the funnel-shaped calyx; calyx 4–5-lobed, lobes broadly rounded or very bluntly pointed 1.3–2 mm. long, 1.5–2 mm. wide and increasingly short-pubescent toward the margins which are abundantly short-ciliate; corolla with 4–5 petals (immature in type specimen); stamens 8–10; pistil immature; ovary with 4–5 locules, each with 6 ovules; fruits irregularly 4–5-angled, tapering to a sharp point at the apex (Plate 2, figures 7, 8), 4.5 cm. long, 2.3 cm. wide, the pericarp showing numerous, evenly distributed, small (0.1–0.2 mm.) slightly sunken oil-glands; seeds thin, flat or nearly so, ovate in outline, 9–13 × 6.5–9 × 1.5–2 mm., dusky gray, very thin at the edges, with a lighter colored, narrow, usually subentire, marginal membrane; embryo monoembryonic.

TYPE: Solomon Islands, Bougainville Island, Buin, Kugu-maru, *S. F. Kajewski no. 1907 a*, rain-forest, alt. 150 meters, 2/7/30, fruiting twig (Herb. Arnold Arboretum, photographs and seeds in Herb. National Arboretum).

COTYPE: Same locality, *S. F. Kajewski no. 1907 b*, twig with young flower-buds (photographs and serial microtome sections of young flower-buds, S. and T. no. 352 A, slides 1 to 5; 352 B, 1, 2; 640 A, 1 to 5 [802 transverse sections]; no. 640 B, 1 to 3 [83 longitudinal sections] in Herb. National Arboretum). This cotype is mounted on the same sheet with the type specimen.

This species at first glance resembles *W. Archboldiana* except that the leaves are narrower and longer and acuminate at the tips. The fruits are entirely different being irregularly 5- or 4-angled, blunt at the base but sharply pointed at the apex.

The mature fruits with ripe seeds of the type specimen were preserved in formaldehyde solution, then dried and attached to the herbarium sheet. These fruits contained nothing but the dry thin flat seeds, almost light enough to be blown by the wind. It is always possible that these fruits which were cut partly open and preserved in formaldehyde

solution may have contained mucilaginous matter which was dissolved by the preserving fluid.

Wenzelia platysperma, sp. nov. PLATE 3, FIGURES 4, 5.

Wenzeliae Archboldianae affinis sed differt (1) foliis angustioribus, apice acuminatis vel caudatis, marginibus irregulariter crenulatis, (2) fructu pendante singulo, subgloboso vel ovato, roseo ex axillis foliorum longe pedicellato, (3) seminibus tenuioribus non deformatis.

Arbor frutexve inermis, 3 m. alta; ramulis junioribus gracilibus, saepe ad nodos alternatim dextrorsum sinistrorsumque deflectis (modo zigzag), internodiis circa 3 cm. longis; foliis elongato-ellipticis, 10–20 × 2.5–5.5 cm., apice acuminatis vel caudatis, basi cuneatis vel rotundatis, margine irregulariter crenulatis (Plate 3, figure 4) vel denticulatis (*Brass no. 7025*); nervis lateralibus utrinque 12–14, sub angulo 70°–80° divergentibus; petiolis brevissimis, 3–4 mm. longis; floribus ignotis, sed calycis lobis ad basim fructus persistentibus, rotundatis, 2 × 2 mm., minute puberulis vel glabrescentibus (Brass no. 7025); fructu subgloboso, 4 × 3.5 cm., vel ovato, 4.8 × 3.5 (Brass 7025), roseo vel puniceo, semper (?) 4-loculari; pedicellis longis et gracilibus ex axillis foliorum ultimorum assurgentibus et pendentibus; seminibus pallide brunneis, 12–15 × 7–9 × 2–3 mm., applanatis, testa margine rugosa vel in membranam tenuem plus minusve laceratam producta; embryone unico, cotyledonibus viridibus.

A thornless tree, 3 m. high; internodes 3 cm. long, often bent slightly at each node alternately to the right and left; leaves chartaceous, elongate-elliptical, 10–20 × 2.5–5.5 cm., acuminate or caudate at apex, cuneate or broadly rounded at base, margins irregularly crenulate (Plate 3, figure 4) or denticulate (in Brass no. 7025), lateral veins 12–14 on each side, arising at an angle of 70°–80° with the midrib; petioles very short, 3–4 × 1.4–1.8 mm. (1/40 to 1/60 of the length of the leaf-blade); flowers not seen, calyx persistent, subtending the fruit, deeply lobed, lobes 2 × 2 mm., broadly rounded, minutely puberulent or glabrous; fruits reddish or pink, subglobose 4 × 3.5 cm., or ovate, 4.8 × 3.5 cm. (in Brass no. 7025) 4-locular (?), borne singly on a slender pedicel 10–12 mm. long, arising in the axil of the uppermost leaf; seeds flattened, light-brown, 12–15 × 7–9 × 2–3 mm., testa rugose on edges or else tapering into thin irregularly shaped extensions with somewhat torn margins, mono-embryonic, cotyledons greenish.

TYPE: New Guinea, Papua, Palmer River, 2 miles below junction with Black River, flood plain forest undergrowth, alt. 100 m., *L. J. Brass*

no. 7111, June 1926, fruiting branch (Herb. Arnold Arboretum; photograph and seeds in Herb. National Arboretum).

COTYPE: Same locality, ridge forest undergrowth, alt. 100 m., L. J. *Brass no. 7025*, June 1936, fruiting branch (Herb. Arnold Arboretum; photograph and seeds in Herb. National Arboretum).

This curious species is known only from the type collections, both made in the same region. These two type specimens show small differences possibly due, in part at least, to the slightly different ecologic environment as no. 7111, the type, was growing in the flood plain and no. 7025 on a ridge.

Wenzelia platysperma is distinguished clearly from all other species of the genus by its slender, elliptical, apiculate or caudate leaves, zigzag internodes and pendant, rose-colored or pink, apparently terminal fruits which are in reality borne singly on a long pedicel arising in the axil of the uppermost leaf on the fruiting branch.

Wenzelia kambarae, sp. nov. PLATE 3, FIGURES 6–8.

Wenzeliae brevipedi proxime affinis sed differt (1) fructu majore sphaerico, (2) seminibus majoribus et praesertim crassioribus, (3) floribus plerumque singulis e foliorum axillis orientibus, (4) foliis magnitudine magis variabilibus.

Frutex vel arbor inermis, 3–7 m. altus; trunco 4–8 cm. diam., ramulis primo viridibus, cito pallide brunneis; foliis tenuiter chartaceis, oblongis vel elongato-ellipticis, magnitudine multo variabilibus, 6–21 × 3–9 cm. (Plate 3, figures 6 and 7), apice obtuse apiculatis vel rotundatis, basi cuneatis vel rotundatis, margine intergerrimis vel paulo crenatis (Naiau Ins.), nervis lateralibus utrinque 8–13 sub angulo variabili (60°–80°) divergentibus, ascendentibus; petiolis 4–7 × 1.5–2 mm.; alabastris (Naiau Ins.) immaturis, 2.5 × 2 mm.; pedicellis tenuibus 6–9 mm. longis, basi bracteis minutis suffultis; sepalis 3, petalis 3, staminibus 8, ovario (juvenili) 3-loculari; fructu subgloboso, 3–4 cm. diam., aurantiaco; pericarpio leviter glandulis oleiferis instructo; pedicellis 14–16 × 1–1.8 mm., carpophoro inter fructum et calycem 1.2–2.5 mm. longo; seminibus magnis crassisque, ovoideis, 1.8–2.5 × 1.2–1.5 cm., testa levi, nitida, albo-flavida; embryone unico vel binis.

A spineless shrub or small tree 4–7 m. high, trunk 4–8 cm. diam., twigs glabrous, green but soon turning light brown; leaves thin, chartaceous, oblong to elongate-elliptical, varying greatly in size and shape, (Plate 3, figures 6, 7), 6–21 × 3–9 cm., bluntly pointed or rounded at apex, broadly cuneate or rounded at base, margins entire or irregularly and shallowly crenate (Zimmerman's Naiau material), lateral veins

8–13 on each side, arising at rather widely varying angles (60°–80°) with the midrib, petioles 5–7 × 1.5–2 mm., tapering; flower buds (Zimmerman's Naiau material) very young, 2.5 × 2 mm., borne on slender pedicels 8–9 mm. long (Plate 3, figure 6), with several minute pointed bracts on the lower portion; fruits orange-colored, 3–4 cm. diam., 3- (or ?4-)locular with a gland-dotted but smooth pericarp, borne on pedicels 14–16 × 1–1.8 mm., with a cylindrical carpophore 1.2–2.5 mm. long between the persistent calyx and the base of the fruit; seeds very large and thick, ovoid, 1.8–2.5 × 1.2–1.5 mm., testa smooth, shiny, cream-colored; embryos 1 or 2 (sometimes more?), greenish colored.

TYPE: Fiji Archipelago, Kambara Isl., *A. C. Smith no. 1265*, Mar. 2–7, 1934, fruiting branch (Herb. New York Botanical Garden; photographs in Herb. National Arboretum).

COTYPE: Same locality and date, *A. C. Smith no. 1293*, fruiting branch (Herb. New York Botanical Garden; photographs in Herb. National Arboretum).

OTHER MATERIAL: Fiji Archipelago, Naiau Island, *E. C. Zimmerman*, Aug. 22, 1938, leafy twigs with young flower-buds, also material in alcohol, (Herb. National Arboretum; photographs in Herb. Arnold Arboretum; also serial microtome sections S. and T. no. 398 A, slides 1–4, and 398 B, 1–4 [518 cross sections]; 398 C, 1–2 and 398 D, 1–2 [140 longitudinal sections] in Herb. National Arboretum).

Dr. A. C. Smith[1] discovered this plant on Kambara Island and gives the native name *moli-moli*, apparently a reduplication of the name *moli* commonly used in Polynesia for the orange, perhaps because the fruits of *Wenzelia* have, when ripe, the color and odor of *Citrus*. Dr. Smith has given me much help in the study of this species.

This species is the easternmost large-seeded *Citrus* relative that occurs on the islands of the Pacific. Its seeds are so large that it is improbable that they would have been carried to Fiji by birds especially since the fruits contain no pulp and little if any mucilaginous matter. It is highly probable that the *moli moli* reached the Fiji Archipelago from the center of origin (probably New Guinea) of the genus *Wenzelia* by slowly spreading eastward over dry land, a migration that would probably have required millions of years to accomplish.

Dr. Edward C. Zimmerman of the Bishop Museum at Honolulu, who made possible the identification of this plant, obtained flower buds by "shooting" the dangerous surf on the atoll surrounding Naiau island.

[1]Smith, Albert C., Fijian plant studies (Bishop Mus. Bull. **141**: 1–160, illus. 1936).

He wrote me that the natives of the Lau group know the plant well by the name *moli moli* and that they told him there were "both pink and red flowers" (perhaps in different stages of development although all other *Wenzelia* flowers, so far observed, are white). The trees on Naiau island were taller (5–7 m.) than those reported from Kambara island (3 m.) but the leaves of the Naiau plants were all smaller (6–10 × 2.5–5 cm.) than the larger ones from Kambara (A. C. Smith no. 1265) (11.5–21 × 4–8.5 cm.). However, another collection from Kambara island (A. C. Smith no. 1293) shows smaller leaves 8–12 × 2.5–5 cm. *Wenzelia kambarae* is doubtless a variable species showing many forms.

Wenzelia tenuifolia, sp. nov.

Wenzeliae brevipedi affine sed differt (1) foliis tenuissimis, apice rotundatis, saepe irregulariter emarginatis, (2) fructu ovoideo nec obovoideo, (3) seminibus magnis, ovatis, plus minusve cuneatis, margine integerrimis, crassis.

Differt a *Wenzelia platysperma* et aliis speciebus subgeneris *Papualimonis* margine seminis integro crasso nec membranaceo tenui laciniato.

Frutex inermis, 2 m. altus, ramulis ultimis gracilibus, 1.1–1.8 mm. diam., internodiis 2–3, raro 5 cm. longis; foliis tenuissimis, in sicco fragilibus, apice irregulariter rotundatis, saepe plus minusve emarginatis, basi cuneatis, nervis lateralibus utrinque 10–12, sub angulo variabili (65°–80°) divergentibus; petiolis brevibus, gracilibus, 4–6 × 1–1.1 mm.; fructu ovoideo, 3.5 × 3 cm., 5-loculari, seminibus 1–4 in quoque loculo, brunneo-fuscis, ovatis, 17–19 × 12–15 × 3.5–5 mm., compressis (in sectione plus minusve cuneatis), saepe margine integris, 1–2 × 1–1.5 mm., crassis vel paulo marginatis, embryone unico.

A spineless shrub, 2 m. high, ultimate branches slender, 1.1–1.8 mm., internodes 2–3 (rarely 5 cm.) long; leaves very thin, brittle when dry, more or less broadly elliptical, 10–13 cm. long including the petiole, 5–7.2 cm. wide, apex bluntly rounded and often imperfectly developed, the very tip being stunted, broadly cuneate at the base and more or less torn, sometimes more or less irregularly emarginate; margins entire, lateral veins 10–12 pairs arising at angles of 65°–80° with the midrib; petioles 4–6 × 1–1.1 mm.; fruit ovoid, 3.5 cm. long × 3 cm. broad, 5-loculate, radial locule walls thin, 1–1.5 mm. thick but expanding into a thick rib of tissue running longitudinally in the fruit; more or less triangular in cross section, 4–7 mm. in radial thickness, dorsal locule walls only 1–2 mm. thick midway between the radial walls; seeds dull brown, ovate, compressed, 17–19 × 12–15 × 3.5–5 mm., more or less wedge-shaped, with a faintly more or less concentrically marked and

corrugated edge, 1–2.2 mm. wide, and 0.5–1.5 mm. thick, on one side of the seed, 1–4 in a locule, often occurring in closely approximated pairs; embryo mono-embryonic.

TYPE: Southeastern New Guinea, Papua, Boridi, forest alt. c[irca]. 4000 [or 11000] feet, *C. E. Carr no. 14881*, 2 branches, 1 fruit, Feb. 1, 1935 (Herb. Berlin-Dahlem; photographs and serial microtome sections, S. and T. no. 666 A, slides 1–8, 666 B, 1–4 (24 cross sections of 1 mature fruit); 666 C, 1–3; 666 D, 1–4 (42 cross sections of 2 mature seeds) Herb. National Arboretum).

This species is known to me only from the rather scanty type specimen, but it is so evidently distinct from all the other known species that I have no hesitation in making it a new species.

It is somewhat of a connecting link between the two subgenera *Euwenzelia* and *Papualimo* but apparently falls in *Euwenzelia* as the seeds lack the paper-thin more or less torn membrane along the free margins of the seeds found in the species of the section *Papualimo*.

The fruits of *W. tenuifolia* are circular in cross section and show five more or less triangular peripheral ribs at the distal ends of the radial locule walls, which fill the spaces between the strongly bulged dorsal locule walls. In striking contrast to this species, *W. Archboldiana* has fruits which are bluntly star-shaped in cross section because of the absence of any tissues filling the inter-locular furrows.

The collector's label on the type specimen is a carbon copy (the original label was doubtless used for another specimen of the plant). The altitude given on the label of the type specimen apparently reads "altitude c. 11000 feet" but may possibly be "c. 4000 feet." If the altitude is 4000 feet (1220 meters) it would be far above the upper limit for the Aurantioid plants in New Guinea (about 300 meters, 914 ft.). If the altitude is 11000 feet (3353 meters) it would equal the highest altitude as yet reported for any Rutaceous plants from New Guinea.[1]

As all the other species of *Wenzelia* grow at low altitudes in tropical regions it will be of interest to learn more about the distribution of *Wenzelia tenuifolia*. Perhaps its curious unusually thin leaves may be adapted for growth in very humid locations such as occur in the cloud belts of mountains.

[1]LAUTERBACH, C., Die Rutaceen Papuasiens (Bot. Jahrb. **55**: 221–223. 1918) gives the *Aurantioideae* as having an altitudinal limit of about 300 meters in New Guinea, but reports that several genera of the *Toddalioideae* and *Xanthoxyleae* are found growing in cloud and fog belts of the mountains at 800–1500 meters altitude and that 3 species of *Acronychia* occur at altitudes from 2700 to 3300 meters.

Wenzelia brevipes Merrill var. **alabatensis,** var. nov.

A typo differt foliis angustioribus glandulis oleiferis paucioribus et inconspicuis instructis.

Leaves long and narrow, 22–28.5 cm. long and 5–6.6 cm. wide, narrowed toward the base, then bluntly rounded. Oil-glands smaller, slightly less numerous and decidedly less conspicuous, especially on the under surface of the leaf.

TYPE: Philippines, Alabát Island (lat. 14° 10′ N., 121° 55′ E.), *M. Ramos and G. Edaño, Bureau of Science 48054,* Sept. Oct. 1926, fruiting twig (Herb. Univ. California, sheet 322,000; photographs and a leaf in Herb. National Arboretum).

This variety is known only from the type collection. It is possible that this extremely narrow-leaved form may be found to intergrade with the species but as yet such intergradations are not in evidence. It is the most northern form known.

TWO SUBGENERA IN WENZELIA

The seven species of Wenzelia that are well known, fall into two groups having very different seeds.

1. EUWENZELIA, subgen. nov.

   Seminibus crassis, plus minusve applanatis, numquam tenuiter marginatis.

   Wenzelia brevipes Merrill (type of subgenus)
   W. tenuifolia Swingle
   W. kambarae Swingle

2. PAPUALIMO, subgen. nov.

   Seminibus tenuibus applanatis, plus minusve tenuiter laciniato-marginatis.

   Wenzelia platysperma Swingle (type of subgenus)
   W. paludosa (Lauterbach) Tanaka
   W. melanesica Swingle
   W. Archboldiana Swingle

It is possible that intergrading forms between these two subgenera may be found when the seeds of the two older species from New Guinea are known.

Doubtless the three species, *Wenzelia brevipes, W. tenuifolia* and *W. kambarae,* that constitute the subgenus *Euwenzelia* are relics of the remote ancestral type of *Wenzelia.* Two of these species are the most widely separated in space of any, *W. brevipes* in the Southern Philippines

and *W. kambarae* in the easternmost Lau Islands of the Fiji Archipelago, about 12,500 kilometers distant!

These three species probably represent ancient ancestral types of the genus *Wenzelia*, while the flat-seeded species found in New Guinea and the Solomon Islands doubtless rapidly evolved there into the subgenus *Papualimo*.

A NEW SPECIES OF PARAMIGNYA

Paramignya is the second largest genus of the tribe CITREAE and the largest in the subtribe TRIPHASIINAE. It is closely allied to *Luvunga*, another large genus with 12 species. Both of these genera include woody lianas that climb to the tops of tall forest trees, hanging on to them by means of their stout retrorse and often recurved spines that are borne singly in the axils of the leaves. *Paramignya* has 1-foliolate leaves with pulvinate petioles that enable them to turn to face the light. *Luvunga* has 3-foliolate leaves borne on long straight petioles pulvinate at the base. Both genera are native to southeastern Asia and the East Indian Archipelago from Sumatra and the Philippines to New Guinea.

The 12 typical species of *Paramignya* constitute a remarkably uniform group and are evidently closely related to each other. Among the many very interesting plants collected in the island of Hainan by American and Chinese botanists and collectors is a species of *Paramignya* of which abundant herbarium specimens are available for study. This species proves to be a new one.

Paramignya confertifolia, sp. nov. PLATE 4, FIGURES 1, 2.

Paramignyae Surasianae Craib et *Paramignyae rectispinosae* Craib affinis sed differt (1) internodiis brevioribus saepe brevissimis, (2) spinis brevioribus vel deficientibus, (3) petiolis saepe brevioribus. A *Paramignya longipedunculata* Merr. differt pistillis multo brevioribus et ab aliis speciebus typicis Asiaticis *Paramignyae* ovariis brevissimis (1.2–2.3 mm.), quam stylo circiter quater brevioribus.

Frutex scandens; internodiis ramulorum juniorum robustiorum 2–3 cm. longis, sed eis ramulorum fructiferorum multo brevioribus (plerisque 8–10 mm. longis); spinis brevibus, 3–10 mm. (plerisque 3–6 mm.) longis, recurvatis; foliis ovatis vel oblongis vel oblongo-ellipticis, basi plerumque rotundatis (in foliis longis aliquando cuneatis), apice acuminatis rotundatis, costa media et 8–12 nervorum paribus utrinque conspicuis sed subtus distinctioribus; margine integris vel irregulariter et tenuiter crenulatis; petiolis 4–12 × 1–1.5 mm., supra planis plus minusve pubescentibus, in sicco rugosis, parte pulvinoidea cum lamina non articulata;

floribus axillaribus, singulis vel pluribus, parvis, aliquando in racemis valde reductis; alabastris cylindricis, 8–10 × 2.5–3.5 mm.; pedicellis brunneo-fuscis gracilibus, 4–5 × 0.5–0.7 mm., glabris, bracteis minutis sparse hirsutis suffultis; pedunculis hirsutis; calycibus parvis, 2 × 1–5 mm., brunneo-fuscis, lobis 5 triangularibus, apice ciliatis; petalis 5 glabris, in vivo albis, brunneo-flavis in sicco, 7–9 vel 10 × 3–4 mm.; staminibus 10, filamentis applanatis, 5–6 mm. longis, antheris linearibus 1.8–2 mm., disco cylindrico non latiore quam basi ovarii; ovario ovoideo, 1.1–1.3 × 1 mm., valde hirsuto (pilis flavo-brunneis), 4–5 loculare, loculis uni-ovulatis apice abrupte contracte in stylum sparse hirsutum vel glabrum, 5–6 × 0.3–0.4 mm., ad basim paulo latiorem et supra graciliorem, post anthesin cito caducum; stigmate depresso-globoso, 0.5 mm. × 1–1.5 mm., (Plate 4, figure 2); fructu 1.5–2 cm. diam., subgloboso, primo glabro, maturo rugosissimo, pericarpio sulcis irregularibus instructo et fere lobato, glandulis oleiferis magnis impressis instructo; seminibus parvis, ovoideis, embryone unico.

A climbing shrub, 3–5 meters high, clambering over shrubs; young twigs with internodes 2–3 cm. long on vigorous shoots, but on fruiting branches much shorter, often only 8–10 mm. long, spines short, 3–10 mm. long (usually 3–6 mm.), recurved; leaves oval or oblong to long-elliptical, usually broadly rounded at the base (sometimes cuneate on longer leaves), acuminate at the tip, the very tip of the acumen bluntly rounded; midrib, and the 8–12 or more pairs of lateral veins visible on both surfaces but more distinct below; margins entire or irregularly and shallowly crenulate; petioles 4–12 × 1–1.5 mm., flattened above, more or less pubescent, wrinkled in dried specimens, pulvinoid portion not articulated; flowers axillary, arising singly or in small clusters, sometimes in greatly reduced racemes; flower-buds cylindrical, 8–10 × 2.5–3.5 mm.; pedicels slender, 4–5 mm. long, 0.5–0.7 mm. wide, glabrous, subtended by minute sparsely hirsute bracts where the pedicels join the hirsute peduncles; calyx small, 2 mm. wide, 1–5 mm. high, brownish buff colored as is the pedicel; calyx-lobes 5, triangular, with ciliate tips; petals 5, glabrous, white when fresh, yellowish brown when dry, 7–9 or 10 × 3–4 mm.; stamens 10, filaments flattened, 5–6 mm. long, anthers linear, 1.8–2 mm. long; disk cylindrical not broader than the base of the ovary; ovary ovoid, 1.1–1.3 × 1 mm., strongly hirsute with yellowish buff hairs, with 4 or 5 1-ovulate locules, narrowed abruptly into the sparsely hirsute or glabrous style, 5–6 mm. long, 0.3–0.4 mm. wide, slightly broader at base and more slender above, deciduous shortly after the flowers open; stigma depressed-globose, 0.5 mm. high and 1–1.5 mm. wide; fruits at first subglobose, glabrous, but when full sized becoming

very rough, sometimes almost lobed with irregularly rugose folds of the pericarp that shows numerous large sunken oil glands, 1.5–2 cm. diam.; seeds small, ovoid, mono-embryonic.

TYPE: China, Hainan Island, Naam Shan leng, *Lau no. 339*, July 30, 1932, flowering branch (Herb. National Arboretum, also serial microtome sections, S. and T. no. 290 A, slides 1–8 [440 transverse sections of 1 flower]).

COTYPE 1: China, Hainan, San Tsuen Mountain, *Tsang Wai Tak, C.C.C. no. 15523*, July 15, 1927, flowering branch (Herb. Univ. Calif., Berkeley, sheet 315941; photographs and serial microtome sections S. and T., 92 A, slides 1–7; 92 B, 1–10; 199 A, 1–9; 199 B, 1–8 [2003 transverse sections of flower bud]; 92 C, 1–4; 199 C, 1–2; 199 D, 1, 2 [204 longitudinal sections of 1 flower bud and of 1 pistil] in Herb. National Arboretum).

COTYPE 2: China, Hainan Island, Nodoa, *Woon Young Chun*, fruiting branch (Herb. Univ. Calif., sheet 236165; photographs and serial microtome sections, S. and T., 495, slides 1–4 [6 transverse sections of 1 nearly mature fruit] in Herb. National Arboretum).

This interesting species is found abundantly in the Island of Hainan clambering over shrubs and small trees. It has been identified wrongly with *P. scandens* Craib but in reality is much more nearly related to two new species recently described from Siam by Craib: *P. Surasiana* and *P. rectispinosa*. Both of these last named species and *P. confertifolia* from Hainan agree in having a very short ovary scarcely more than 1 mm. long with a style 4–5 times as long. The other species of *Paramignya* native in southeastern Asia have much larger ovaries, usually several mm. tall and the style is only 3 or 4 times as long as the ovary.

The Philippine species, *P. longipedunculata* Merr., also has a very short ovary (about 1.5 mm.) with a very long style (about 15 mm.) which is nearly as wide as the ovary and not clearly delimited from it. However, this Philippine species differs widely in many other characters from *P. confertifolia* and is not closely related to it.

The fruits of this species are very peculiar; as they ripen they become exceedingly irregular in shape, rough and wrinkled. Upon sectioning, the pericarp is found to be of unusual thickness and to be filled with a multitude of large and small oil glands. No other species of the Orange subfamily yet discovered has so striking a development of oil glands in a soft and spongy pericarp.

A NEW SPECIES OF ATALANTIA

Professor E. D. Merrill kindly sent me for examination a new species

of *Atalantia* named by him and Professor Chun. By his permission I am including it here; it is a very curious species as will appear later.

Atalantia hainanensis Merrill et Chun in herb., sp. nov.

PLATE 4, FIGURES 3–7.

Atalantiae ceylanicae remote affinis sed differt (1) fructu ellipsoideo nec sphaerico cum stylo plus minusve persistente, vesiculis pulpiferis paucissimis vel deficientibus, (2) foliis magnitudine variabilissimis, apicibus acutis vel paulo acuminatis, (3) disco cupulari, (4) ovario 2-loculari.

Frutex parvus, 2 m. altus; ramulis junioribus leviter angulosis, demum teretibus; foliis simplicibus, crassis, coriaceis, ellipticis vel late ellipticis, apice paulo acuminatis vel obtusis, saepe emarginatis, basi cuneatis, sensim in petiolum attenuatis, magnitudine variabilissimis, plerumque 6–16 cm. × 2.5–6 cm. petiolo incluso, sed aliquando 19.5 × 7.5 cm., aliquando 2.5 × 0.8 cm., margine integerrimis vel leviter crenulatis; petiolis 5–10 cm. longis, plus minusve pulvinoideis nec cum lamina articulatis; inflorescentiis axillaribus brevibus, 1–1.5 cm. longis, in racemis pauciflori; alabastris parvis, 3–3.5 mm. longis, 2–2.5 mm. latis; sepalis 5, triangularibus, crassis, tota superficie, margine tenui ciliata excepta, glandulis oleiferis asperata; petalis 5, albis; staminibus 10, filamentis crassis, basi connatis, supra liberis, antheris glandula oleifera singula in connectivo instructis; ovario parvo, 1.5 × 1 mm., ovoideo, 2-loculari, ovulis 2 collateralibus in quoque loculo, supra utrumque loculum una glandula oleifera magna instructo; stylo gracili, 1.5 × 0.3–0.4 mm., stigmate fere quam stylo isodiametrico, duobus paribus glandularum oleiferum instructo; disco cupulari, circa 0.35 mm. alto, glabro, 2/5 ovarii inferioris cingente; fructibus (novellis) ellipsoideis, 8–10 × 4–5 mm., pericarpio viridi, numerosis glandulis et stylo parvo persistente 1 × 0.6 mm. instructo; semine singulo, 8 × 4.5 × 3.5 mm., in quoque fructu (vel pluria?); embryone unico; cotyledonibus glandulis oleiferis numerosis instructis.

A small spineless shrub, 1–2 m. high; young twigs slightly angled but soon becoming cylindrical; leaves simple, persistent, thick and coriaceous, elliptical or broadly elliptical, slightly acuminate or bluntly pointed at the tip, often emarginate, cuneate at the base, narrowing gradually into the petiole very variable in size, usually 6–15 × 2.5–6 cm., sometimes as large as 19.5 × 7.5 cm. and sometimes as small as 2.5 × 0.8 cm. inclusive of the petiole, margins entire or faintly undulate; petiole not articulated with the leaf blade, 5–10 mm. long, more or less pulvinoid; inflorescences axillary, short (1–1.5 cm. long), racemose,

few-flowered; pedicels slender, 2–3 × 1 mm.; flowers small, 3–3.5 mm. long, 2–2.5 mm. wide; calyx with 5 triangular thickened lobes, roughened with oil-glands except at the thin and ciliate margins; petals 5, white; stamens 10, filaments flattened, connate at the base, free above, anthers with 1 large oil-gland in the connective; ovary small, 1.5 × 1 mm., ovoid, with 2 locules, each with 2 collateral ovules, top of ovary with 1 large oil-gland above each locule; style slender, 1.25 × 0.3–0.4 mm., stigma nearly isodiametric with the style, with 2 pairs of large oil-glands; disk cupulate, about 0.35 mm. deep, glabrous, completely surrounding the basal 2/5 of the ovary; fruits (young) ellipsoid, 8–10 × 4–5 mm.; pericarp green, with numerous oil-glands, surmounted by the small persistent style, 1 × 0.6–0.7 mm.; seeds 1 (or more?) to a fruit, large, ellipsoid, about 10 × 7 × 5 mm., mono-embryonic, cotyledons with numerous oil-glands.

TYPE: China, Hainan Island, Po Ting, *F. C. How no. 72807*, in forest, near stream, alt. 300 meters, June 12, 1935, flowering branch (Herb. Arnold Arboretum; photographs and serial microtome sections S. and T. no. 261 A, slides 1–6; 261 B, 1–4 [534 transverse sections of 2 flower buds], 261 C, slides 1–2 [48 longitudinal sections of a flower bud] also 1 leaf and 1 fruit in Herb. National Arboretum).

COTYPE 1: Type locality; *F. C. How no. 73976,* fruiting branch, Nov. 3, 1935 (Herb. Arnold Arboretum; photographs and serial microtome sections, S. and T. no. 263 A, slides 1–3, and 263 B, 1–3 [186 transverse sections of 2 fruits] also 1 leaf and 1 fruit in Herb. National Arboretum).

COTYPE 2: Type locality; *F. C. How no. 73068,* flowering branch, July 4, 1935 (Herb. Arnold Arboretum; photographs and serial microtome sections, S. and T. no. 262 A, 1 slide [39 longitudinal sections of a young flower bud] also 1 leaf in Herb. National Arboretum).

OTHER MATERIAL: Type locality, *F. C. How no. 73718,* fruiting branch, Sept. 25, 1935; Type locality, *F. C. How no. 72461,* small-leaved branch with very young fruits; Type locality, *F. C. How no. 73207,* very large-leaved flowering branch, July 17, 1935; China, Hainan Island, Yaichow, alt. 100 meters; *N. K. Chun and C. L. Tso, no. 44603,* fruiting branch (?), Dec. 1932 (Herb. Arnold Arboretum).

This curious plant, clearly a very distinct new species, is hard to place in the absence of mature fruits. It has leaves varying greatly in size (2.5–19.5 × 0.8–7.5 cm.) having much the general aspect as those of *Severinia buxifolia* Ten. which species it also resembles in having a cupular disk and a 2-loculate ovary. However, the serial microtome sections made of the immature fruits of the cotype (How 73976) do not

show a clear-cut inner layer of stalkless subglobose pulp-vesicles lining the walls of the locule but rather large and variable-sized oil-glands (?) that are not in a definite layer lining the walls but scattered between the much smaller oil-glands of the pericarp and the inner wall of the locule. Study of the fruits of this species at all stages of development may show that these structures have a merely superficial resemblance and no true homology with the primitive pulp-vesicles of *Severinia buxifolia* and other typical species of *Severinia*. The typical species of *Atalantia* have sessile, broad-based, conical pulp-vesicles growing out from the dorsal locule walls and, with the seeds, filling the locules completely. However, *Atalantia ceylanica* (Arn.) Oliver, the type-species of the subgenus *Rissoa*, shows in the mature fruit very few pulp-vesicles, perhaps because the very large seeds almost completely fill the locules. This species like *Atalantia hainanensis*, has a cup-shaped disk fitting closely around the base of the ovary. *Atalantia Guillaumini* Swingle, an anomalous species of which only the very large subglobose, fully mature fruits are known, does not seem to have any pulp-vesicles among the very large seeds.

Study of more complete material of *A. Guillaumini* and *A. hainanensis* may show them both to be aberrant species of *Severinia* rather than of *Atalantia*.

EXPLANATION OF PLATES

PLATE 1

Limnocitrus littoralis (Miquel) Swingle. Figure 4, type specimen in Rijks Herb. Leiden. Figures 1, 2, 3, 6, Clemens no. 3263, Tourane, Annam, in Herb. Arnold Arboretum. Figure 5, Chevalier no. 30526, Nha-trang, Annam, in Herb. National Arboretum.

Figure 1. Flowering twigs. Nat. size.

Figure 2. Serial microtome sections of pedicels, calyx, disk and pistil. × 4.

Figure 3. Cross section of flower bud. × 8.

Figure 4. Cross section of immature fruit from type specimen. × 4.

Figure 5. Cross section of nearly ripe fruit. × 6.

Figure 6. Flower buds, and flower after fall of petals. × 4.

PLATE 2

Wenzelia Archboldiana

Figure 1. Leaf and fruits showing fusiform cracks in outer peel. Coll. Brass no. 8038, Lower Fly River, New Guinea. ½ nat. size.

Figure 2. Fruit seen from side. Brass no. 8038. Nat. size.
Figure 3. Fruit in cross section showing an empty locule and 5 of the 8 seeds it contained. Brass no. 8038. ½ nat. size.
Figure 4. Longitudinal section of a flower ready to open. (Coll. Clemens no. 6673, Sattelberg, Morobe Distr., New Guinea). × 3.
Figure 5. More highly magnified view of same flower bud showing disk separated from base of ovary by a slanting constriction. × 11.

Wenzelia melanesica

Figure 6. Twig with leaf and young fruit. (Coll. Kajewski no. 1907[a], Buin, Bougainville Island, Solomons). ½ nat. size.
Figure 7. Dry fruit from Kajewski no. 1907[a]. Nat. size.
Figure 8. Cross section of a 5-locular dry fruit, and flattened seeds. (Kajewski no. 1907[a]). ½ nat. size.

PLATE 3

Wenzelia melanesica

Figure 1. Cross section of young flower bud. (Coll. Kajewski no. 1907[b]. Buin, Bougainville Isl., Solomons). × 10.
Figure 2. Longitudinal section of young flower bud. (Kajewski no. 1907[b]). × 10.
Figure 3. Two young flower buds in axil of a leaf. (Kajewski no. 1907[b]). × 2½.

Wenzelia platysperma

Figure 4. Leaf attached to a fruiting branch. (Coll. Brass no. 7111, Fly River Valley, New Guinea, type). ½ nat. size.
Figure 5. Flattened seeds. (Brass no. 7111). ½ nat. size.

Wenzelia kambarae

Figure 6. Young flower buds and small leaves. (Coll. Zimmerman, Naiau Island, Fiji Archipelago). Nat. size.
Figure 7. Fruiting twig with large leaves; and fruit with a plump white seed. (Coll. Smith, Kambara Isl., type). ½ nat. size.
Figure 8. Longitudinal section of flower bud. (Coll. Zimmerman, Naiau Island). × 10.

PLATE 4

Paramignya confertifolia

Figures 1 and 2. Type specimen, Hainan Island (Lau 339).
Figure 1. Crowded leaves and flowers. ½ nat. size.
Figure 2. Longitudinal microtome section of pistil. × 11.

Atalantia hainanensis

Figures 3–6. Type specimen, Hainan Island (F. C. How 72807).

Figure 3. Longitudinal section of flower bud showing cupulate disk, oil-gland in anther, etc. ×10.

Figure 4. Cross section of flower bud showing disk surrounding the 2-locular ovary, etc. × 10.

Figure 5. Cross section of flower bud showing tip of ovary with 2 large oil-glands. × 10.

Figure 6. Leaves and flower buds. ½ nat. size.

Figure 7. Cotype specimen (F. C. How 73976). Leaves and young fruits. ½ nat. size.

DIVISION OF PLANT EXPLORATION AND INTRODUCTION,
BUREAU OF PLANT INDUSTRY, U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.